

COMPLEX ANALYSIS

HOMEWORK 8

- (1) Determine $\text{res}_c(f)$ for all $c \in \mathbf{C}$ of the following:
 - (a) $f(z) = \frac{(z-1)^2}{(e^z-1)^3}$
 - (b) $f(z) = \cos\left(\frac{1-1}{z}\right)$
 - (c) $f(z) = \sin(1+z^{-1})\cos(1+z^{-2})$
- (2) With the help of the residue theorem show that
 - (a) $\int_{\partial B_2(0)} \frac{1}{\sin^2 z \cos z} dz = 0$
 - (b) $\int_{\gamma} \frac{e^{\pi z}}{(z^2+1)} dz = -\pi$, where γ is the boundary of $B_2(0) \cap \mathbf{H}$ (here \mathbf{H} is the upper half plane).
- (3) Find the Laurent series expansion in \mathbf{C}^* of $\exp(z^{-1})^{-1}$.